

Remarks/Arguments

The Office Action of February 10, 2006 and the references cited therein have been carefully studied and reviewed, and in view of the foregoing Amendment and following representations, reconsideration is respectfully requested.

1. The Rejection of Claim 35 as Being Unpatentable Under 35 USC 103 Over Okada et al. (USP 6,534,397) in View of Kim (USP 6,576,947).

a. The rejection should be withdrawn because it is based on an improper interpretation of Applicants' claim 35

Claim 35 sets forth a trench forming process wherein a first etching process using a photoresist pattern as an etch mask is preformed to form an initial trench in an insulation film, the photoresist pattern is removed, and a second etching process is subsequently performed so as to widen the trench without substantially altering the depth of the trench. Refer to par. [0125] of Applicants' original specification, for example.

Okada et al. (USP 6,534,397) discloses a dual damascene method wherein a **trench 23 is formed** in an insulation film 13/15 **using only a photoresist pattern 21** as an etch mask (FIG. 2H to 2I as described at col. 11, lines 38 - 44).

Regardless, the Examiner refers to forming an initial "trench" in the insulation film 13/15 using a photoresist pattern 18 as an etch mask. With all due respect, this position of the Examiner mischaracterizes the disclosure of Okada et al. The photoresist pattern 18 referred to by the Examiner is used for forming a "via" opening in the film 13/15 (FIGS. 2C and 2D) and not a "trench", given the plain meaning

ascribed by those of ordinary skill in the semiconductor device manufacturing art to the term “trench”. Refer to MPEP 2111.01 for the requirement that the Examiner **must** read the words in a claim as they would be interpreted by those of ordinary skill in the art. As would be clear from any technical literature in the field of semiconductor device manufacturing, those of ordinary skill in the art would not equate a “via” with a “trench”. (Note, in this respect, in the reference relied on by the Examiner herself, Okada et al. never refer to opening 20 formed using photoresist patter 21 as a trench but only use the word “trench” in connection with the opening 23 formed using photoresist pattern 21). Therefore, the entire basis for the rejection of claim 35 by the Examiner is flawed and the rejection should be withdrawn.

b. The rejection should be withdrawn because there is no suggestion that would have motivated one of ordinary skill in the art to have combined the references.

Okada et al. teach a dual damascene process of forming a contact plug 25 “for interconnecting vertically spaced apart metallization levels” (col. 2, lines 21 – 34). On the other hand, Kim teaches a method of forming cell capacitors having HSG cylindrical layers.

The Examiner opines that those of ordinary skill in the art would have been motivated to have replaced the plasma dry etch trench-forming stage shown in FIG. 2H to FIG. 2I of Okada with the wet etching technique taught by Kim merely because the wet etching is an “alternative suitable” technique. In support of her position, the Examiner refers to MPEP 2144.07.

MPEP 2142 and 2143, and MPEP 2144.07 relied on by the Examiner, make it clear that the prior art itself must suggest the suitability of the teachings of the secondary reference for use in the invention disclosed in the primary reference.

As col. 11, lines 38 – 50 of Okada would make clear to anyone of ordinary skill in the art, a wet etch process would not at all be suitable technique for forming the trench 23 of the dual damascene structure of Okada. If the structure shown in FIG. 2H were subject to wet etching, the low-k ILD layer 13 would be etched along with the low-k ILD layer 15. That is, there is nothing in the prior art that suggests that wet etching is a suitable alternative to plasma dry etching for forming the upper wide trench in a low-k ILD in a dual-damascene process.

Moreover, Okada et al. in fact only disclose a single etching process for forming a trench in the insulation film 13/15, namely trench 23, to accommodate the upper portion of a contact plug 25. In Kim, the only reason that the trench 312 is widened is to allow for the cylindrical capacitor with an HSG layer to meet the 170 nm design rule of the photolithography process conventionally employed for storage node formation (see, for example, the paragraph spanning columns 7 and 8 in Kim). Nothing about this need in forming cylindrical capacitors also pertains to the forming of contact plugs. Thus, again, the prior art fails to provide any suggestion to combine the references in the manner proposed by the Examiner.

2. New Claim 49

New dependent claim 49 specifies that the second etching step is performed without the use of an etch mask. Neither of the references relied on by the Examiner

to reject independent claim 35 teach or suggest a wet etching step wherein a trench can be widened without changing the depth thereof and without the use of an etch mask. Accordingly, the references can not render the subject matter of new claim 49 obvious under 35 USC 103.

3. The Rejection of Claims 23 as Being Obvious Unpatentable under 35 USC 103 Over Okada et al. (USP 6,534,397) in view of Kim (USP 6,576,947) and Lee et al (US 2002/0055271).

Claim 23 specifies that the second etching process is carried out using a solution that includes hydrogen fluoride and phosphoric acid.

Contrary to the position taken by the Examiner, Lee et al. do not teach an etch solution that **includes** both hydrogen fluoride **and** phosphoric acid. Rather, Lee et al. only mention individual etching solution, one being an LAL solution that includes hydrogen fluoride) and another being a solution of phosphoric acid. In this respect, the attention of the Examiner is respectfully directed to FIG. 9 of the Lee et al. reference mentioned in par. [0137]. FIG. 9 shows that the experiments were performed either with an SC-1 solution, an LAL solution **or** a phosphoric acid solution. Thus, the reference fails to teach the second etching step of claim 23.


For these reasons, namely the lack of suggestion that would have motivated one of ordinary skill in the art to have combined the references in a manner resulting

in Applicants' claims 23 and 35, it is seen that the references do not render the subject matter of such claims obvious under 35 USC 103. Accordingly, early reconsideration and the allowance of all of Applicants' claims are respectfully requested.

Respectfully submitted,

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